

ATTACHMENT 2-11 IG AIR MONITORING PLAN

1.0 INTRODUCTION

1.1 This attachment describes the U.S. Army Dugway Proving Ground (DPG) air-monitoring plan for Igloo G. This attachment is part of the Part B Hazardous Waste Permit for Igloo G.

1.2 The objective of this plan is to describe air monitoring policies and procedures to ensure that:

- Harmful vapors are not released to the environment
- Personnel are not exposed to harmful vapors
- Chemical agent spills are detected in a timely manner

1.3 This plan describes the policies, requirements, and responsibilities for air monitoring of chemical warfare materiel (CWM), which includes range recovered munitions (RRM) at Igloo G. It includes the following sections:

- Facility Description
- Analytical Parameters
- Sampling and Analysis
- Frequency of Monitoring
- Response to Agent Detection
- Plan Review and Evaluation

1.4 Tables and figures appear as close as possible to where they are first mentioned.

2.0 FACILITY DESCRIPTION

2.0.1 This section describes Igloo G and its vapor controls.

2.1 General Description

2.1.1 Igloo G is located at Carr Facilities on DPG. The structure is designed to protect and safely store CWM at DPG.

2.1.2 Igloo G is a concrete structure measuring 26 feet wide by 80 feet long covered with 2 feet of earth. The inside temperature of Igloo G is passively maintained at approximately 21 degrees Celsius (70 degrees Fahrenheit) year around. The air monitoring equipment is powered with a mobile generator.

2.1.3 Igloo G is equipped with an intrusion alarm system and 24-hour exterior lighting. High security chain link fencing surrounds the entire structure. Large barricades ("King Tut" barricades) are placed in front of the entrance. Security personnel visually monitor Igloo G on a daily basis.

2.1.4 Igloo G is used to store CWM including:

- G series (GA, GB, GD, GF)
- V series (VX)
- H series (HD)

- Lewisite (L)

2.1.5 Sampling lines transfer air from specific locations in Igloo G to monitoring equipment located in the monitoring room or monitoring trailer. Sampling lines vary in length from a few feet to over 50 feet. All sampling lines are made of Teflon® and are heated to prevent condensation. Vacuum pumps are used to pull air from each sampling point to the monitoring device.

2.2 Vapor Controls

2.2.1 The ventilation design of Igloo G, with its minimal airflow, works to contain potential vapor releases resulting from leakage or spills. Figure 1 depicts the airflow in Igloo G. The igloo has two vents, one on each side of the front doors. There is one round vent on the back wall near the roof. Outside air enters the igloo through two vents in the front and exits through the vent near the roof. The airflow exchange rate is 25 to 30 cubic feet per minute. A complete exchange of air within the igloo requires approximately 15 hours. This low rate allows heavier-than-air vapors to collect at floor level.

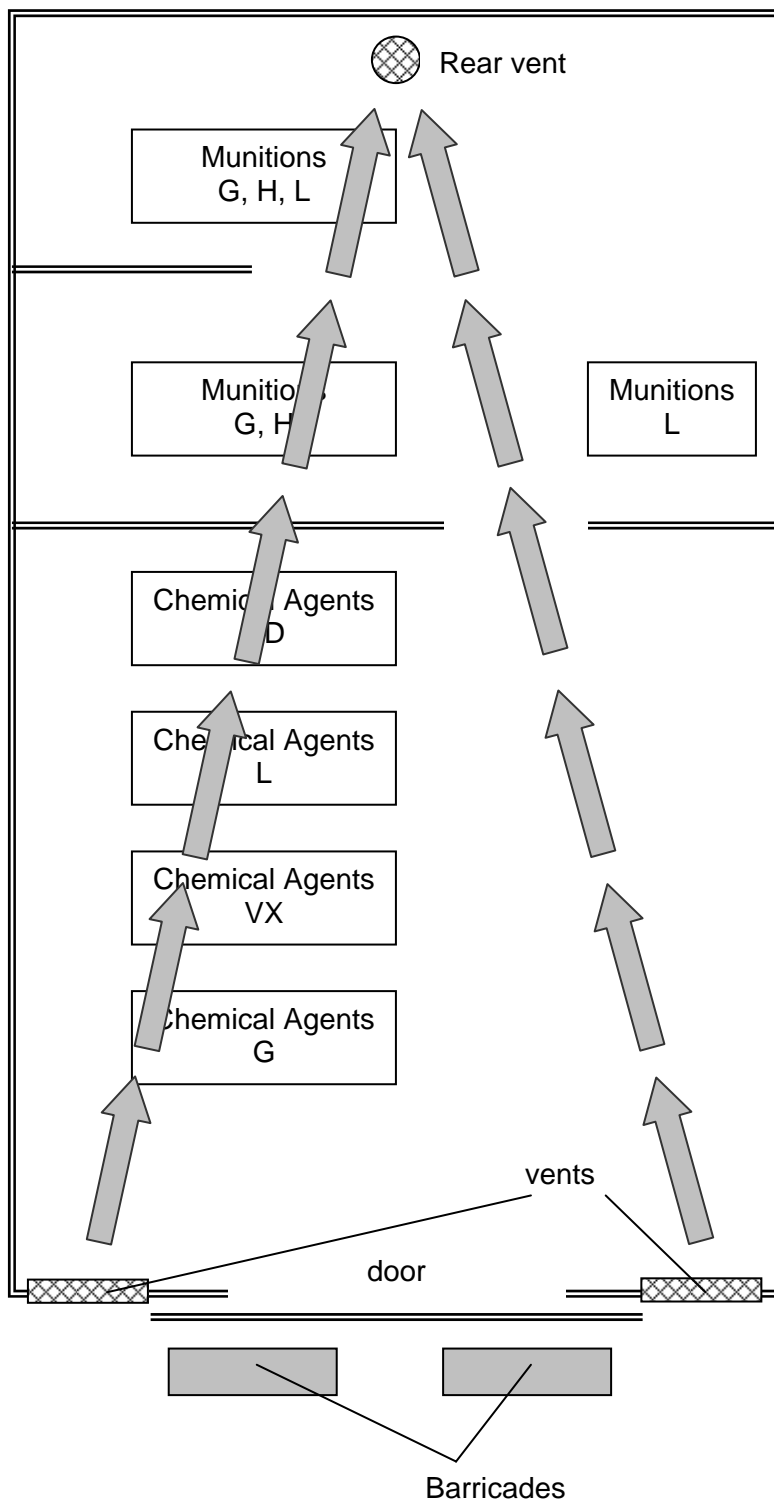
2.2.2 Under normal circumstances, Igloo G vent filters are unnecessary. If a release of chemical agent is confirmed, a mechanical vapor filter system is immediately attached to the roof vent and operated to prevent the release of harmful vapors.

3.0 ANALYTICAL PARAMETERS

3.1 Air monitoring analytical parameters includes each chemical agent stored in Igloo G. A list of the chemical agents stored in Igloo G and their Air Exposure Levels are presented in Table 1. Air Exposure Levels are based on short-term exposure limit (STEL).

Table 1 Action Levels for Chemical Agents Stored in Igloo G.			
Chemical Agent	Short-Term Exposure Limit (STEL) (milligrams per cubic meter)	Action Level Factor	Action Level (milligrams per cubic meter)
GA	0.0001	0.2	0.00002
GB	0.0001	0.2	0.00002
GD	0.00003	0.2	0.000006
GF	0.0001	0.2	0.00002
VX	0.00001	0.2	0.000002
HD	0.003	0.2	0.0006
Lewisite	0.003	0.4	0.0012
GA ethyl N,N-dimethylphosphoroamidocyanide HD bis (2-chloroethyl) sulfide GB isopropyl methylphosphonofluoridate GD pinacolyl methylphosphonofluoridate GF cyclohexyl methylphosphonofluoridate VX o-ethyl s-2-diisopropylaminoethyl methylphosphonothioate L Chlorovinyl dichloroarsine			
These levels apply for Igloo G monitoring or when air monitoring is the primary analysis method for hazardous waste acceptance to the CHWSF (such as for solid test-related debris, ventilation filters, etc.).			

Figure 1. Airflow Pattern in Igloo G.



4.0 SAMPLING AND ANALYSIS

4.0.1 Igloo G air monitoring samples are collected and analyzed according to the operating procedures listed in Table 2 or equivalent methods approved by the Executive Secretary. Typical sampling methods include Miniature Continuous Air Monitoring System (MINICAMS), bubblers, and Depot Area Air Monitoring System (DAAMS). Analysis methods include MINICAMS and gas chromatography (GC) specified in Attachment 1-1 and Attachment 1-10.

4.0.2 Primary and secondary sampling and analysis methods are listed in Table 2. Typical locations of sampling points and air monitors are shown in Figure 2.

Table 2. Igloo G Sampling and Analysis Methods.			
Chemical Agent	Primary Sampling and Analysis Method(s)		Secondary Sampling and Analysis Methods
GA	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography)
GB	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography) or CL-056R/CL-025R (Bubbler with gas chromatography)
GD	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography) or CL-056R/CL-025R (Bubbler with gas chromatography)
GF	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography)
VX	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography) or CL-056R/CL-025R (Bubbler with gas chromatography)
HD	CL-044R (MINICAMS)		CL-022R/CL-052R (DAAMS with gas chromatography)
Lewisite	CL-044R (MINICAMS)		CL-056R/CL-025R (Bubbler with gas chromatography)
GA	ethyl N,N-dimethylphosphoramidocyanidate	GF	cyclohexyl methylphosphonofluoridate
GB	isopropyl methylphosphonofluoridate	MINICAMS	Miniature Continuous Air Monitoring System
GD	pinacolyl methylphosphonofluoridate	VX	o-ethyl s-2-diisopropylaminoethyl methylphosphonothioate
L	Chlorovinyl dichloroarsine		
HD	bis (2-chloroethyl) sulfide		

4.1 MINICAMS

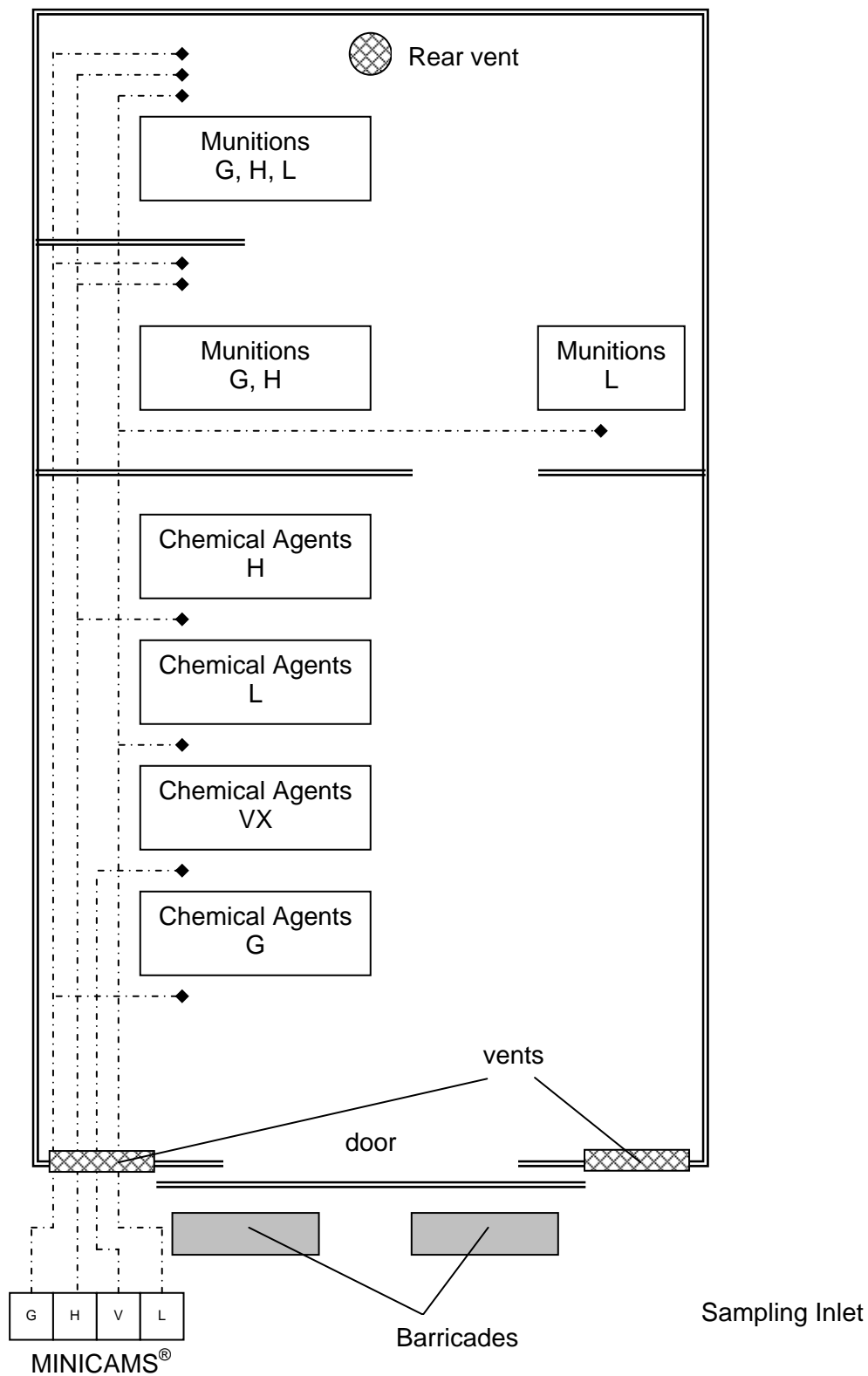
4.1.1 MINICAMS portable GC systems are the primary tool for monitoring chemical agents. MINICAMS analysis is performed after monitoring lines have been thoroughly purged. MINICAMS analysis is performed by drawing a specific volume of air through the instrument's pre-concentrator tube. Chemical agent analytes are retained on the pre-concentrator tube materials. Chemical agents are desorbed from the pre-concentrator tube into the GC where they

are separated from each other in the GC column. The chemical agents are then detected as they elute from the GC column. The MINICAMS is configured specifically for each chemical agent.

4.1.2 The following quality control (QC) requirements apply to Igloo G air monitoring using MINICAMS.

- Instrument operators should have documented training in the analysis and reporting of chemical agents.
- Calibration should be performed each time the instrument is moved to a new location, if significant changes are made to the instrument, or if the calibration verification standard also known as QC standard fails more than twice consecutively.
- Calibration should be performed using liquid standards with known and documented concentrations.
- Calibration should be performed with at least one standard at a liquid concentration approximately equivalent to the STEL level for each analyte.
- A calibration verification must be performed at the action level for each analyte in Table 1.
- A calibration verification standard also known as QC standard should be analyzed at the beginning and end of each run.
- The calibration verification standard recovery at the action level shall be greater than 50% recovery.
- The calibration verification standard at the STEL recovery should be within ± 25 percent.
- Documentation should enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.
- Raw data should be clearly indicate:
 - Identification of each standard and sample run also known as “shot”
 - Name of operator
 - Date of analysis
 - Instrument number
 - Sample line location
 - Start and end times of sample collection
 - Start and end flow rates
 - Start and end QC results
 - Calibration verification standard also known as QC standard identification number
 - Volume of calibration verification standard also known as QC standard injected
 - Operator’s initials and date of sampling
- All raw and summary data should be readily available for review.

Figure 2. Location of Sampling Points and Monitoring Locations.



4.2 Bubblers SAMPLING with Gas Chromatography Analysis

- 4.2.1 Bubblers are used to collect samples for quantitative analysis of Lewisite. Bubblers may also be used to collect GB, GD, and VX for subsequent GC analysis. Analysis is performed after monitoring lines have been thoroughly purged. Drawing a specific volume of air through a sorbent solution performs bubbler sampling. 120 liters (L) of air is collected by sampling for 120 minutes at a flow rate of 1.0 L per minute. The solution is transferred to the laboratory for GC analysis.
- 4.2.2 An organic solvent, such as chloroform, is used to extract chemical agents from the bubbler solution. Injecting a known volume of the extract into the GC where chemical agents are separated from each other in the GC column performs GC analysis. The chemical agents are then detected as they elute from the GC column. The GC is configured to detect each chemical agent.
- 4.2.3 The following QC requirements apply to Igloo G air monitoring using bubblers and subsequent GC analysis.
- Sample collection personnel shall have documented training in the collection of chemical agents.
 - Instrument operators shall have documented training in the analysis and reporting of chemical agents.
 - Samples shall be delivered to the laboratory as soon as possible after collection.
 - Samples shall be maintained on ice or in a refrigerator prior to analysis.
 - Calibration shall be performed for each run.
 - Calibration shall be performed with at least one standard at a liquid concentration approximately equivalent to the STEL level for each analyte.
 - A calibration verification standard also known as QC standard shall be analyzed at the beginning and end of each run.
 - Calibration verification standard also known as QC standard recovery shall be within ± 15 percent.
 - Documentation shall enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.
 - Bubbler sample collection documentation shall clearly indicate:
 - Name of sample collection personnel
 - Date of sample collection
 - Sampling location
 - Bubbler identification number
 - Volume of bubbler solution
 - Start and end time of sample collection
 - Flow rate
 - Ambient temperature
 - GC raw data shall clearly indicate:
 - Instrument and method parameters
 - The identification of each standard and sample
 - Name of operator
 - Date of analysis
 - Instrument number
 - Start and end QC results

- Calibration and calibration verification standards also known as QC standard identification numbers
- Operator's initials and date
- All raw and summary data shall be readily available for review.

4.3 Depot area air monitoring system SAMPLING with Gas Chromatography Analysis

4.3.1 DAAMS solid sorbent tubes shall be used for collecting samples for analysis of chemical agents other than Lewisite. Analysis is performed after monitoring lines have been thoroughly purged. Drawing a specific volume of air through a DAAMS sorbent tube performs sample collection. The DAAMS tube is transferred to the laboratory for GC analysis.

4.3.2 GC analysis is performed by first, desorbing the DAAMS tube onto the instrument transfer tube. Chemical agents are then desorbed from the transfer tube into the GC where they are separated from each other in the GC column. The chemical agents are then detected as they elute from the GC column. The GC is configured to detect each chemical agent.

4.3.3 The following quality control requirements apply to Igloo G air monitoring using DAAMS and subsequent GC analysis.

- Sample collection personnel shall have documented training in the proper collection of chemical agents.
- Instrument operators shall have documented training in the proper analysis and reporting of chemical agents.
- Samples shall be delivered to the laboratory as soon as possible after collection.
- Samples shall be maintained on ice or in a refrigerator prior to analysis.
- Calibration shall be performed for each run.
- Calibration shall be performed with at least one standard at a liquid concentration approximately equivalent to the action level in Table 1 for each analyte.
- A calibration verification standard also known as QC standard shall be analyzed at the beginning and end of each run.
- QP Calibration verification standard also known as QC standard recovery shall be within ± 15 percent.
- Documentation shall enable an independent reviewer to easily recreate all aspects of standard preparation, sample analysis, and reporting.
- DAAMS sample collection documentation shall clearly indicate:
 - Name of sample collection personnel
 - Date of sample collection
 - Sampling location
 - DAAMS identification number
 - Volume of bubbler solution
 - Start and end time
 - Flow rate
 - Ambient temperature
- GC raw data shall clearly indicate:
 - Instrument and method parameters
 - The identification of each standard and sample
 - Name of operator
 - Date of analysis

- Instrument number
- Start and end QC results
- Calibration and calibration verification standard also known as QC standard identification numbers
- Operator's initials and date
- All raw and summary data shall be readily available for review.

5.0 FREQUENCY OF MONITORING

- 5.1** First entry monitoring is performed prior to entry into Igloo G for any reason. Safety inspections and air monitoring is conducted at least once per month. Trained and qualified personnel perform air monitoring.
- 5.2** Monitoring begins before the door of Igloo G is opened and continues during chemical agent operations. At least two MINICAMS cycles are completed with negative readings prior to entering the igloo. When alternate methods are used analysis is completed and negative results received before the first entry crew enters the igloo.

6.0 RESPONSE TO AGENT DETECTION

- 6.1** The MINICAMS signals an alarm when it detects chemical agent above the action level listed in Table 1. Required actions for air monitoring detections are summarized in Table 3.

Table 3	
Required Actions for Igloo G Agent Detection	
MINICAMS Air Monitoring Result	Required Action
Below (AL)	No Action
Above AL, First Occurrence	Notify inspection personnel to don PPE, evaluate data, continue monitoring
Above AL, Second Occurrence	Notify inspection personnel to exit Igloo G, start confirmation process using alternate method
Below AL, Two Consecutive Clear Cycles	Site manager can authorize reentry into Igloo G
Above STEL, Two Consecutive Cycles	Evacuate area and wait for results from confirmation monitoring. Implement the Igloo G Contingency Plan as necessary (Attachment 2-7).
Above STEL, Confirmed with Alternate Method	Implement Igloo G Contingency Plan (Attachment 2-7). Notify State DSHW as required in Attachment 2-7, Section 11
AL = Alarm Level listed in Table 1	
STEL = Short-term Exposure Limits listed in Table 1	

7.0 PLAN REVIEW AND EVALUATION

7.1 The Directorate of Environmental Programs regularly reviews and evaluates this Air Monitoring Plan to ensure suitability and effectiveness. The results of the review are documented, and any changes implemented are followed with verification of implementation.

7.2 The review includes the following:

- Review and evaluation of internal and external audit findings
- Consideration of external influences such as new technology, changing or new regulations, organizational changes, etc.
- Recommendations by safety personnel and employees